Supplementary materials for Separation of Manga Line Drawings and Screentones

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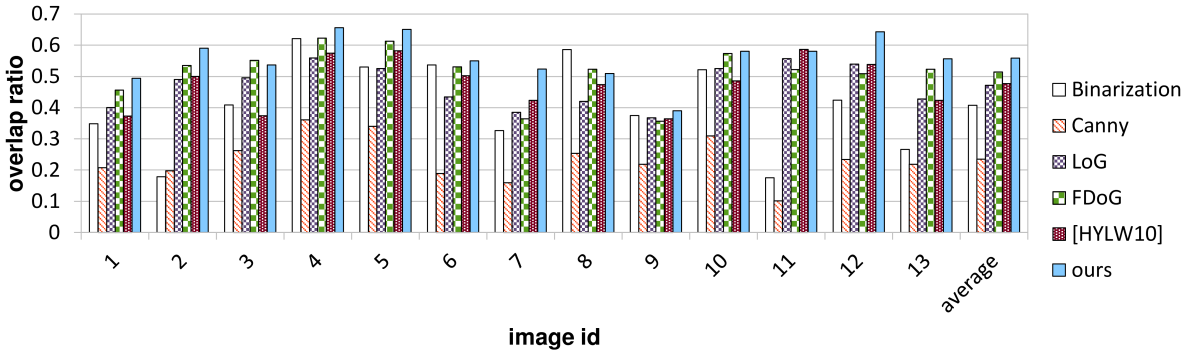


Figure 1: *Overlap ratio for all images in the comparative evaluation.*

1. Results

We show all scores in the comparative evaluation in Fig. 1, and all results including original images and ground truth images in Fig. 2 to Fig. 14. Because the simple binarization keeps black-filled areas, which are defined as screentones in our case, we used a mask calculated by Eq. (1) as a result of *binarization*:

$$M_b \equiv Bin(I) \wedge (\neg Dilate_2(Bin(I))), \qquad (1)$$

where I is an input image, $Bin()$ is Otsu's binarization method [Ots75], and $Dilate_i$ is the ith iteration of the dilation operator. $\neg$ denotes a pixel-wise inversion.

The results show that the Canny edge detector and Binarization are useless for images that include dense screentones as shown in Fig. 2. LoG filter based methods (*LoG* and [HYLW10]) tend to generate discontinuous lines as shown in Fig. 14. The FDoG filter tends to leave some screentones as shown in Fig. 6, 12. Our method can produce results with clean surfaces and continuous clear lines.

2. Results of scale variation

The results of scale variation are shown in Fig. 15, 16, and 17(a).

Fig. 15 and Fig. 16 are successful results. We can derive similar results with the same parameter from original size, double size, and quadruple size images.

Fig. 17(a) is a failed example. Fig. 17(b) is a plot of CCC of an original size result and Fig. 17(c) is that of double size. This image has a nonperiodic screentone and such screentones are removed gradually as the Gaussian kernel size increases. When the size of the image is doubled, such screentones are removed more slowly and the CCC value becomes smaller. Our algorithm cannot handle such cases. In this case, we can obtain a moderate image by using $\beta = 0.4$. If the size increases, smaller β may be required.

References

[HYLW10] Huang M., Yang M., Liu F., Wu E.-H.: Stroke extraction in cartoon images using edge-enhanced

isotropic nonlinear filter. In *Proc. VRCAI* (2010), ACM, pp. 33–38. 1

[Ots75] Otsu N.: A threshold selection method from gray-level histograms. *Automatica 11*, 285-296 (1975), 23–27. 1

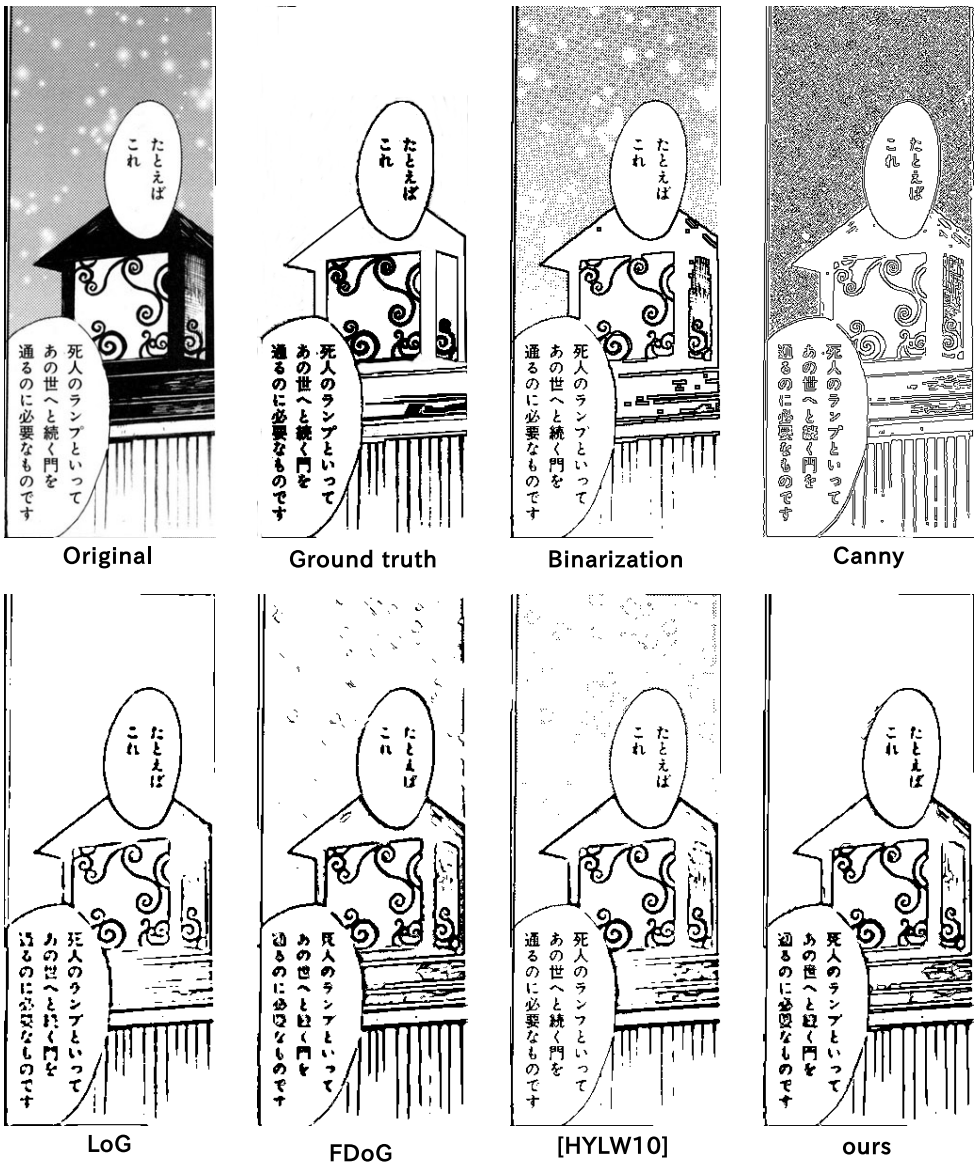


Figure 2: *Result 1 ©Junichiro Akabi*

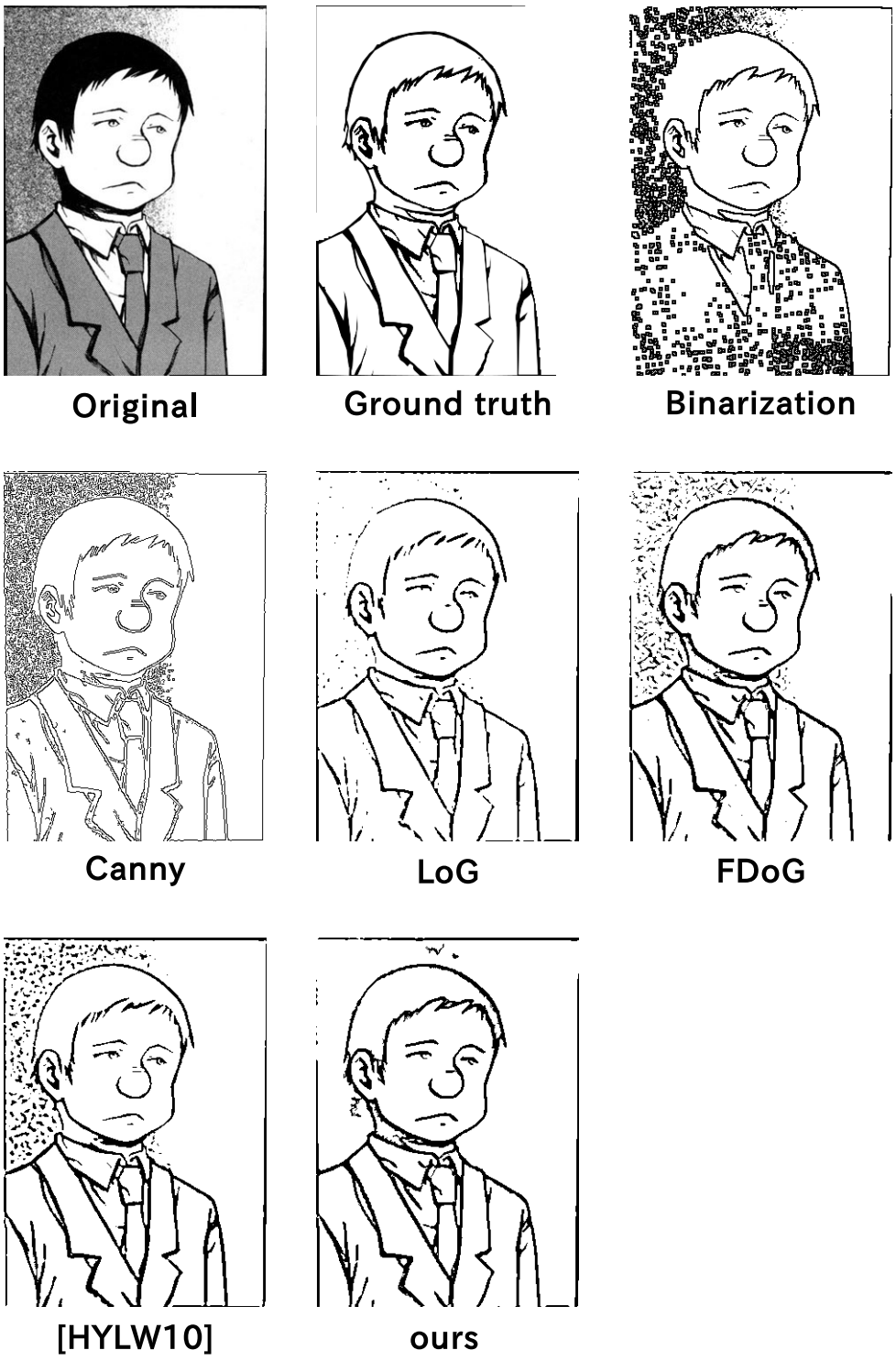


Figure 3: *Result 2 ©Junichiro Akabi*

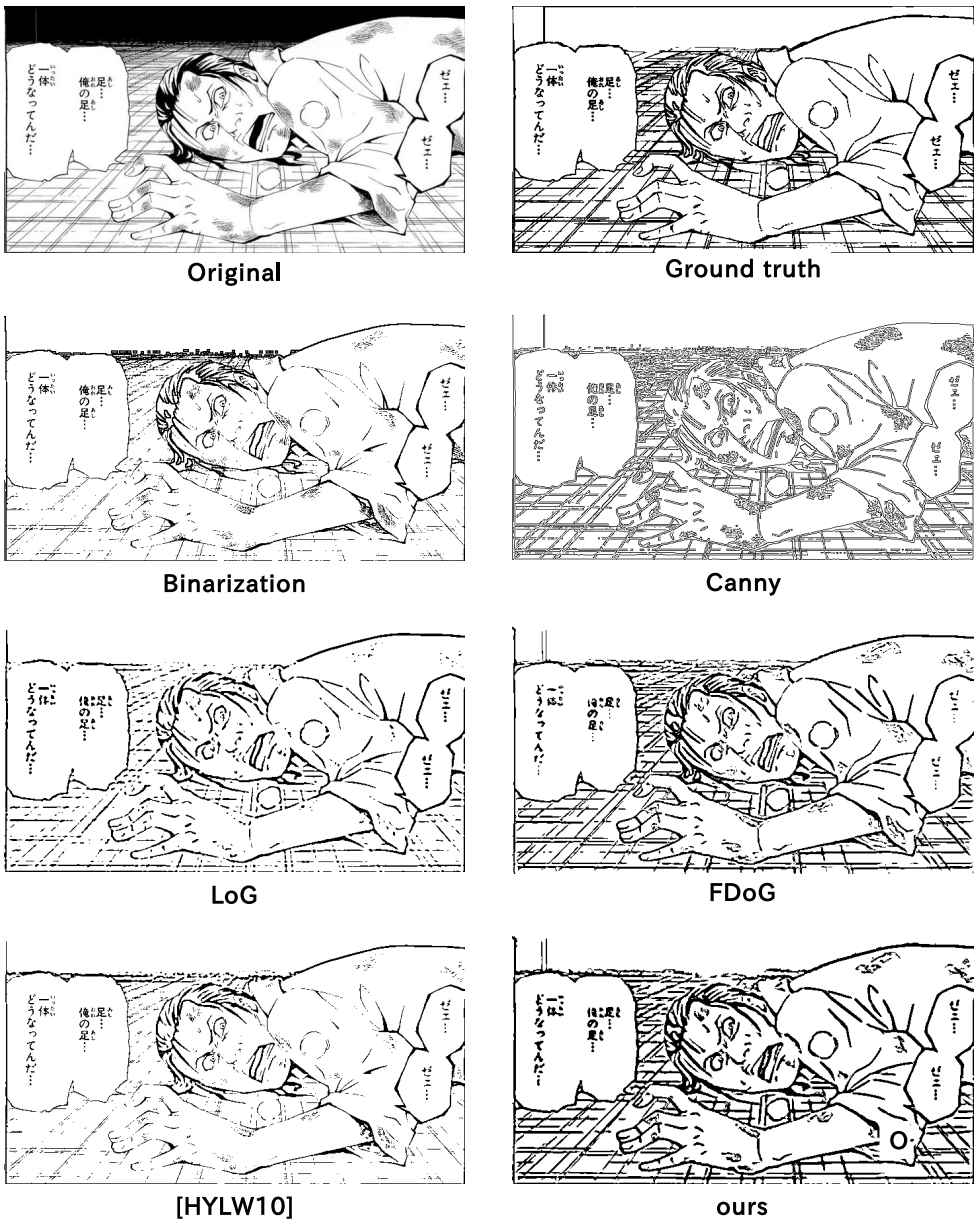


Figure 4: *Result 3 ©Shouei Ishioka*

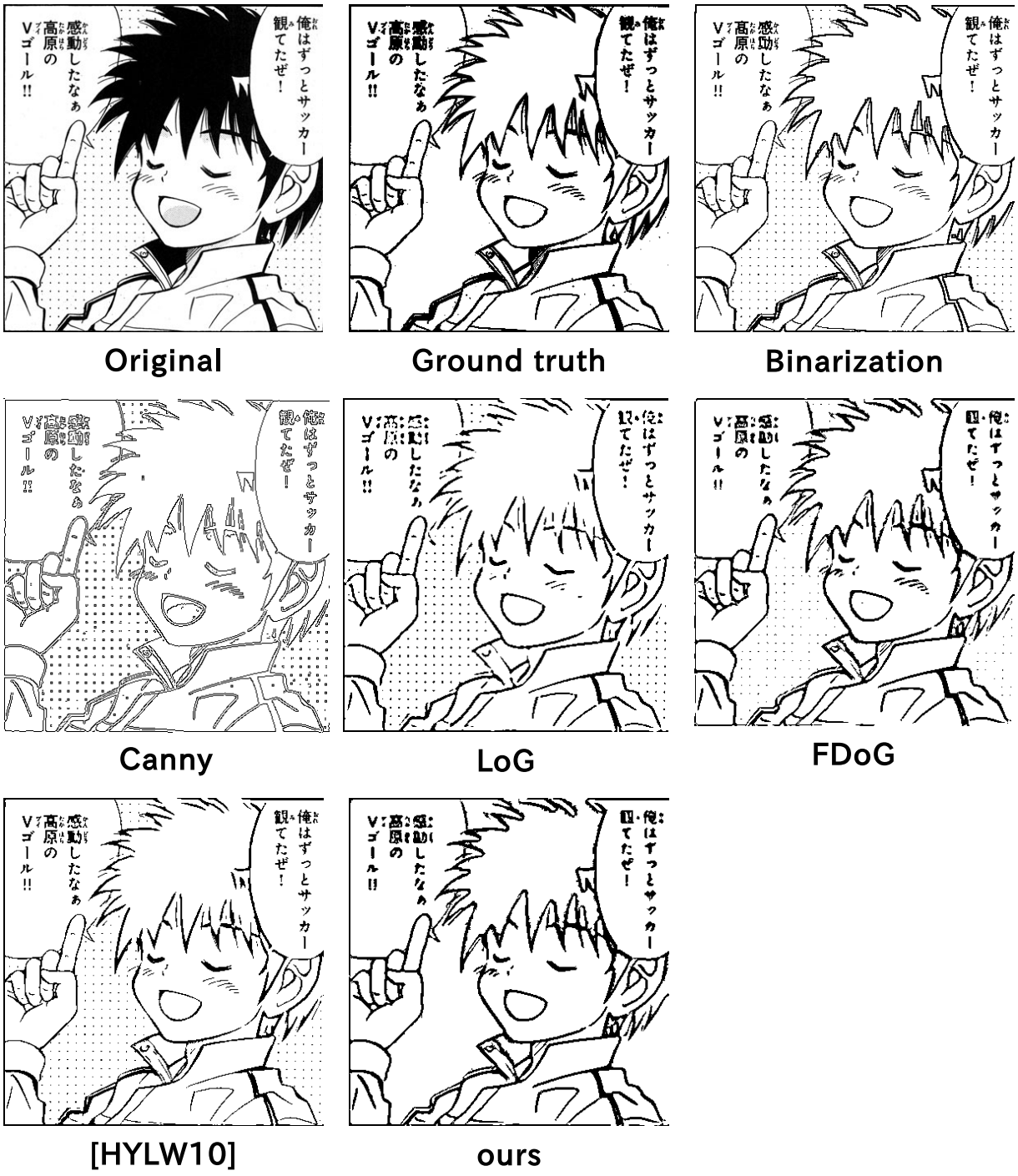


Figure 5: *Result 4 ©Motoi Takenaka*

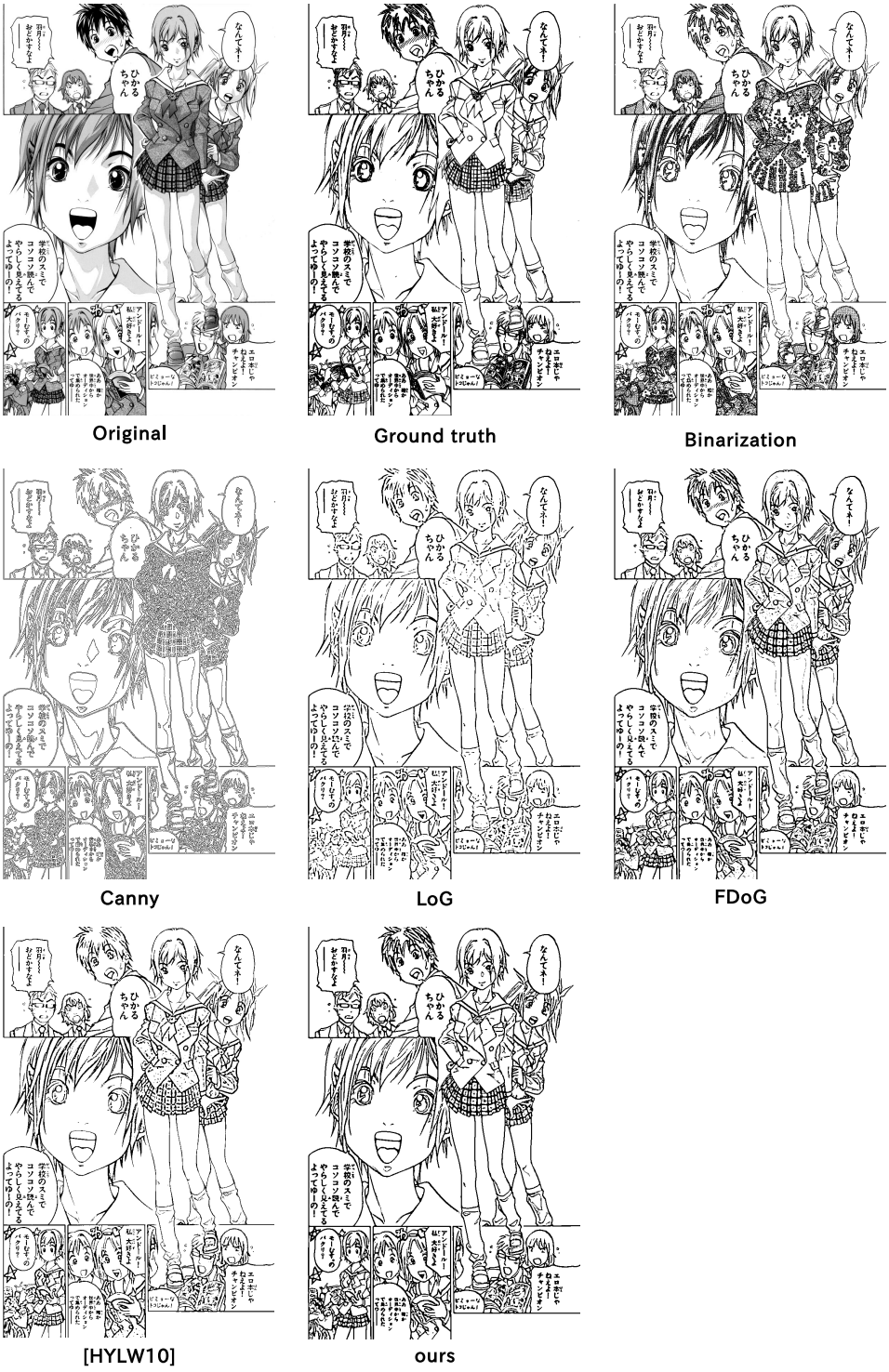


Figure 6: *Result 5* ©*Ryusei Deguchi*

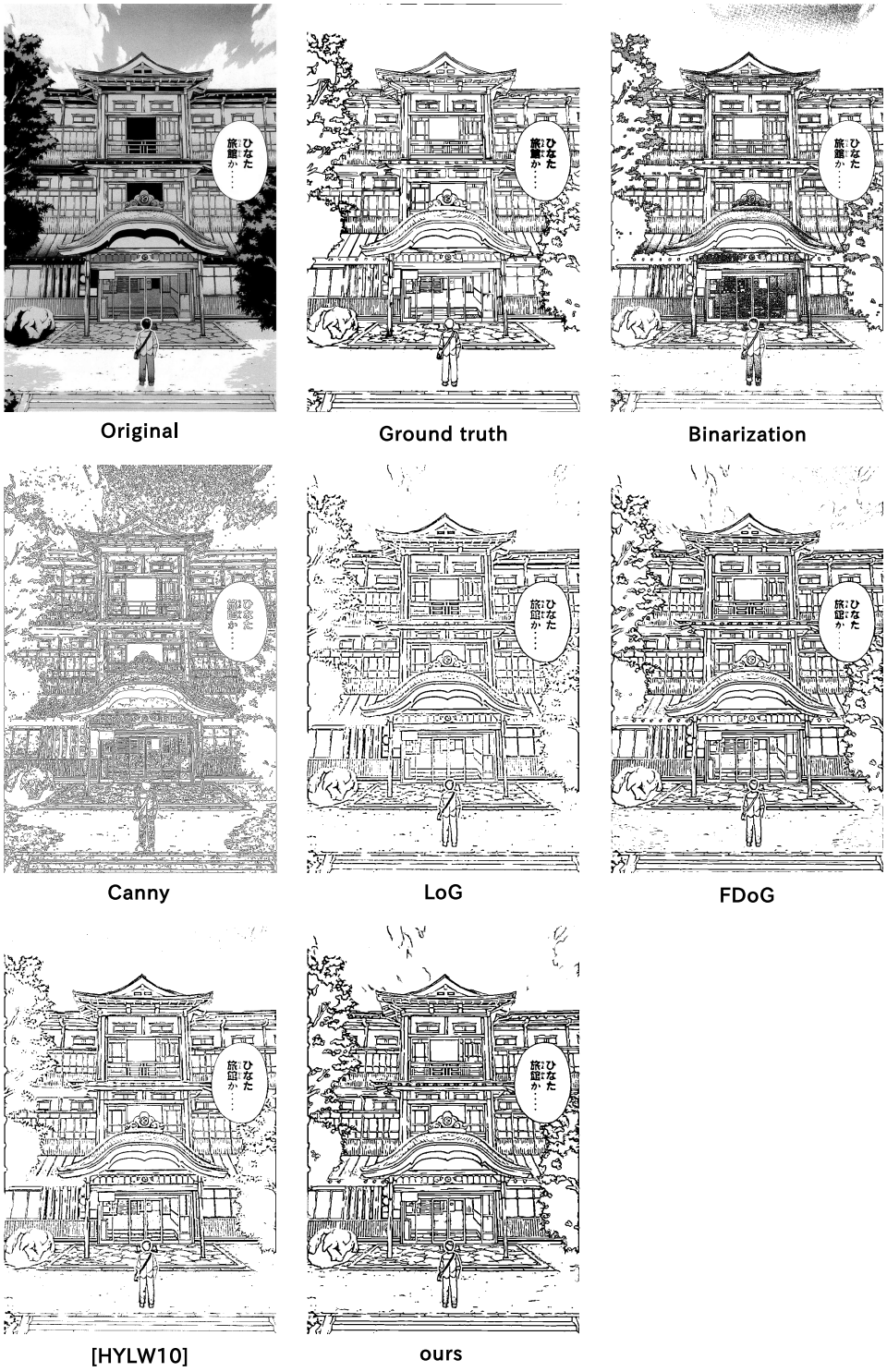


Figure 7: *Result 6 ©Ken Akamatsu*

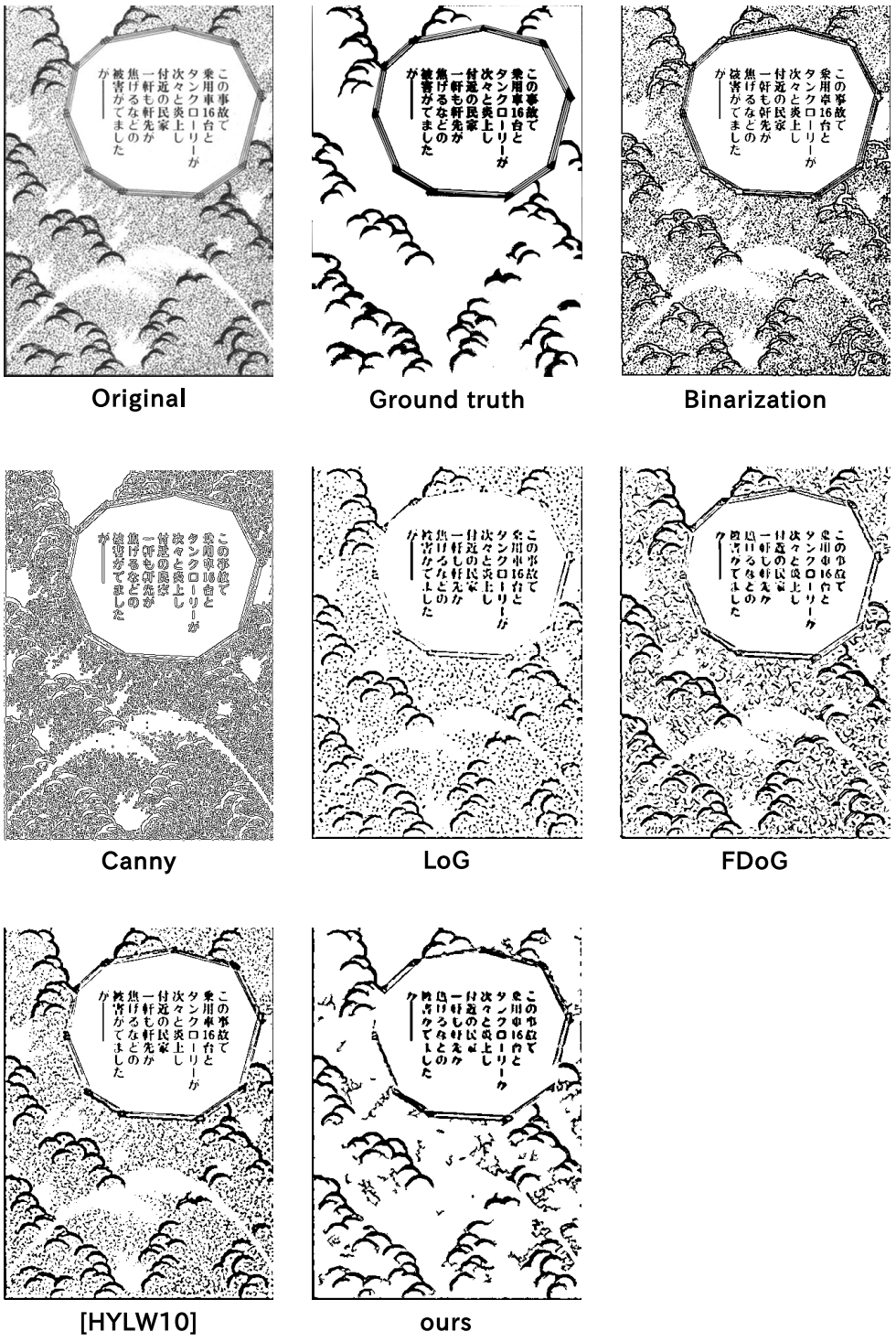


Figure 8: *Result 7 © Tetsuya Kurosawa, Hidehisa Masaki*

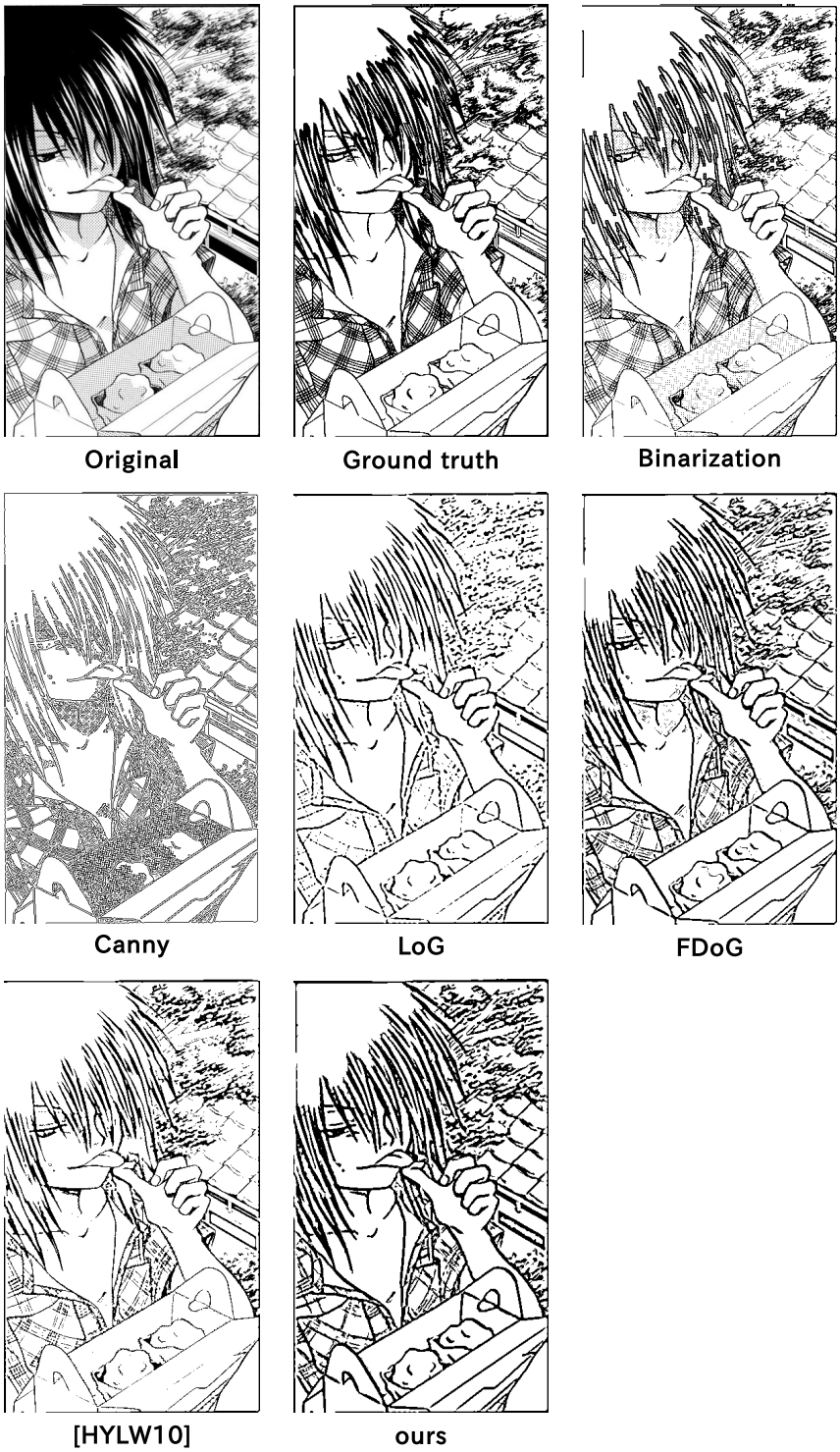


Figure 9: *Result 8 ©Saya Miyauchi*

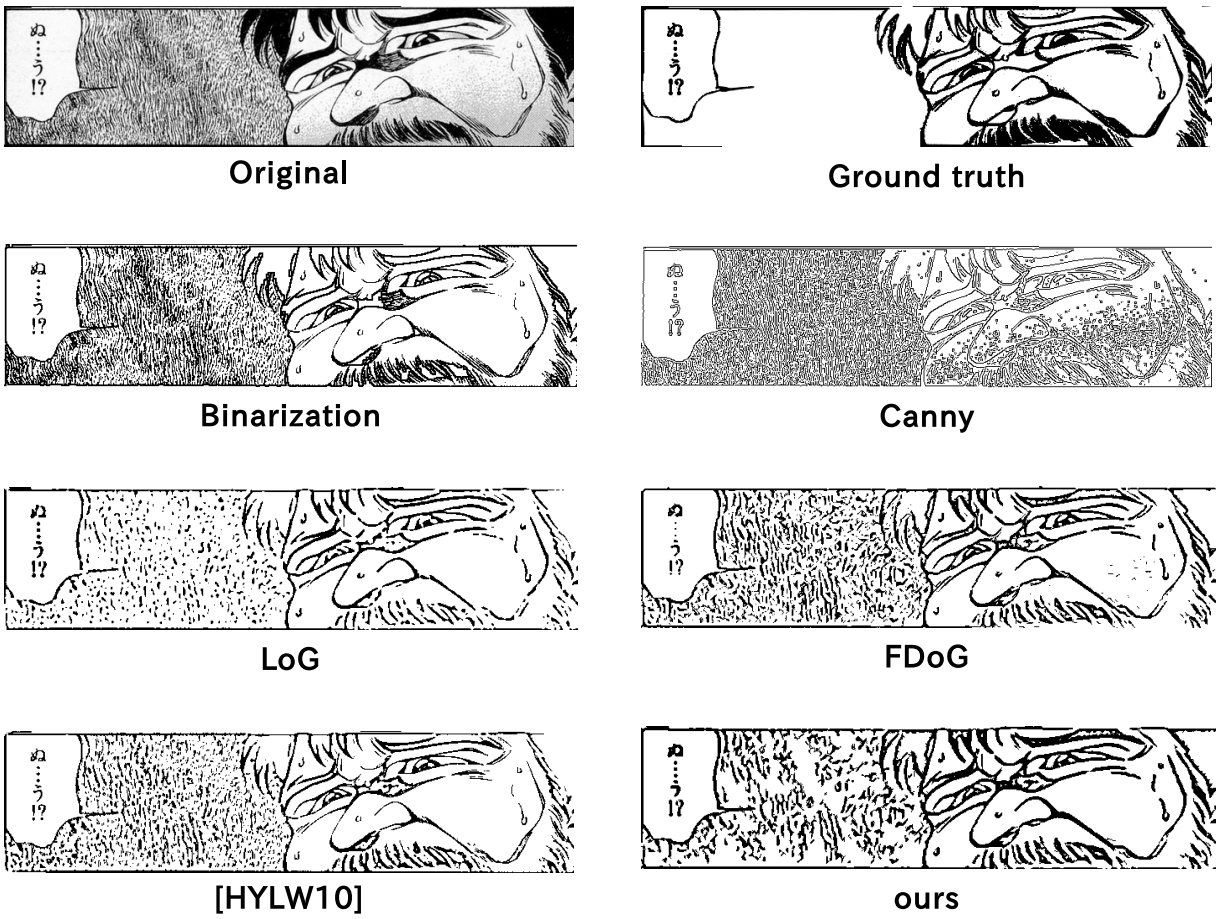


Figure 10: *Result 9 © Tetsuya Kurosawa, Hidehisa Masaki*

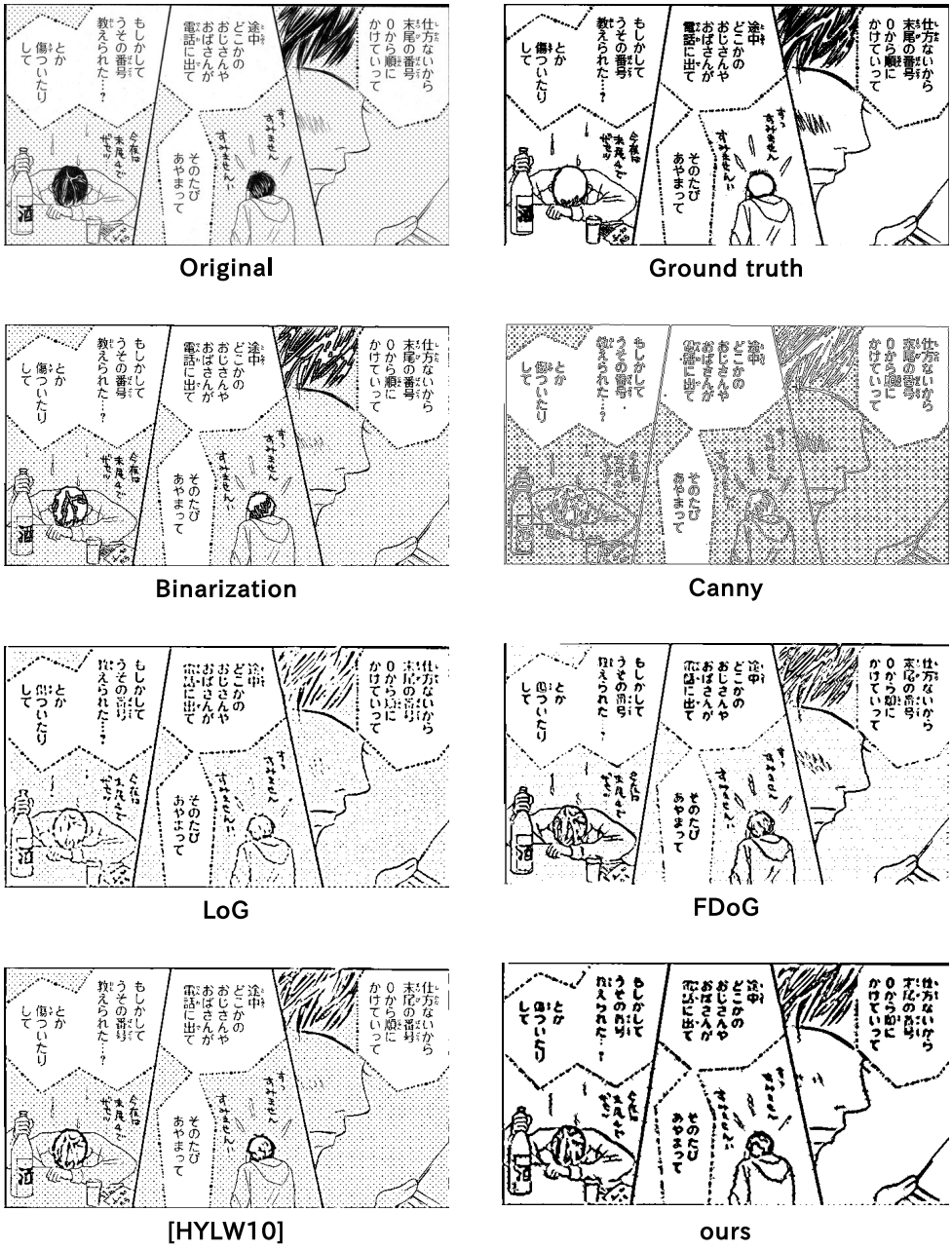


Figure 11: *Result 10 ©Hotaru Yawzawa*

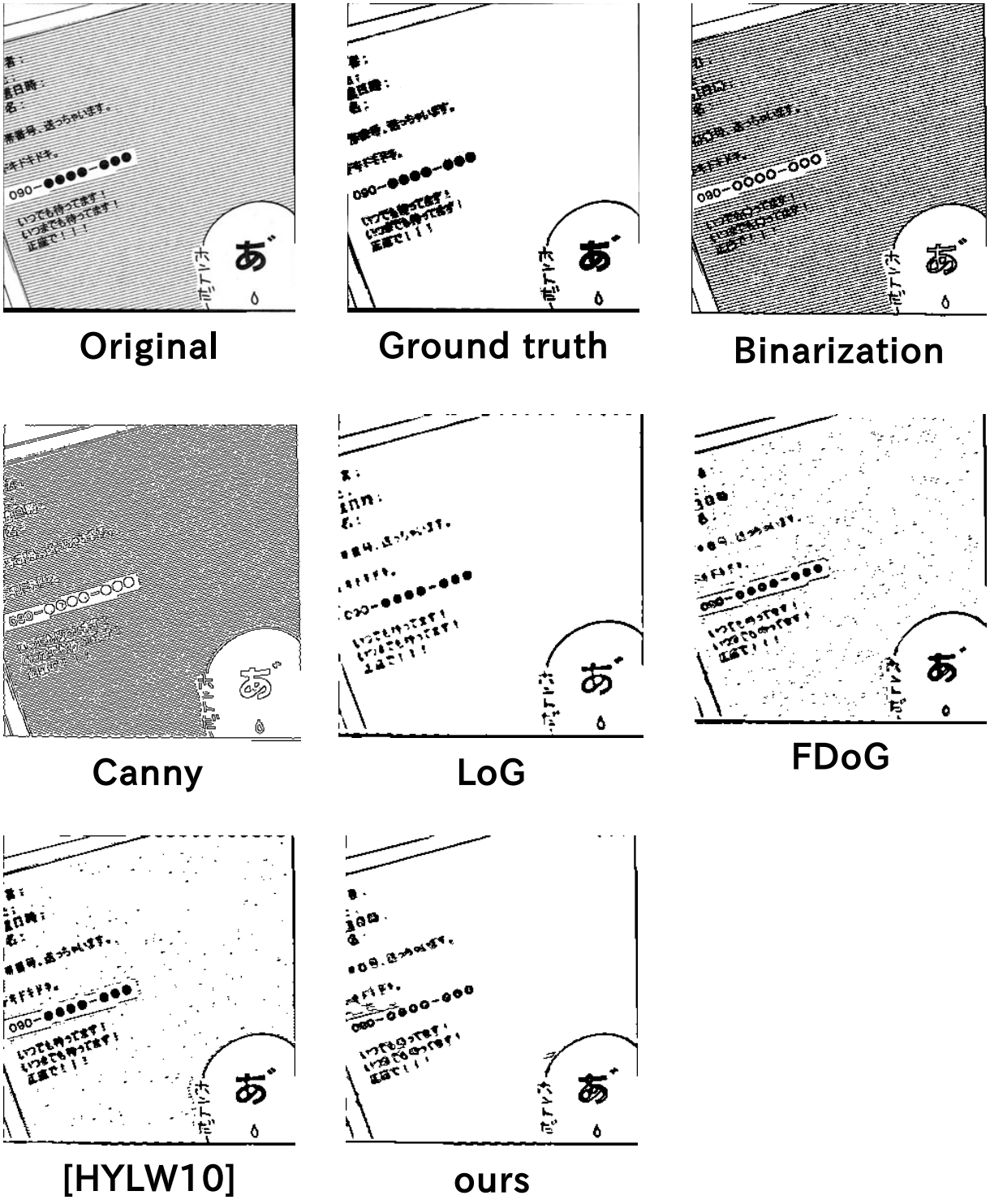


Figure 12: *Result 11 ©Hotaru Yazawa*

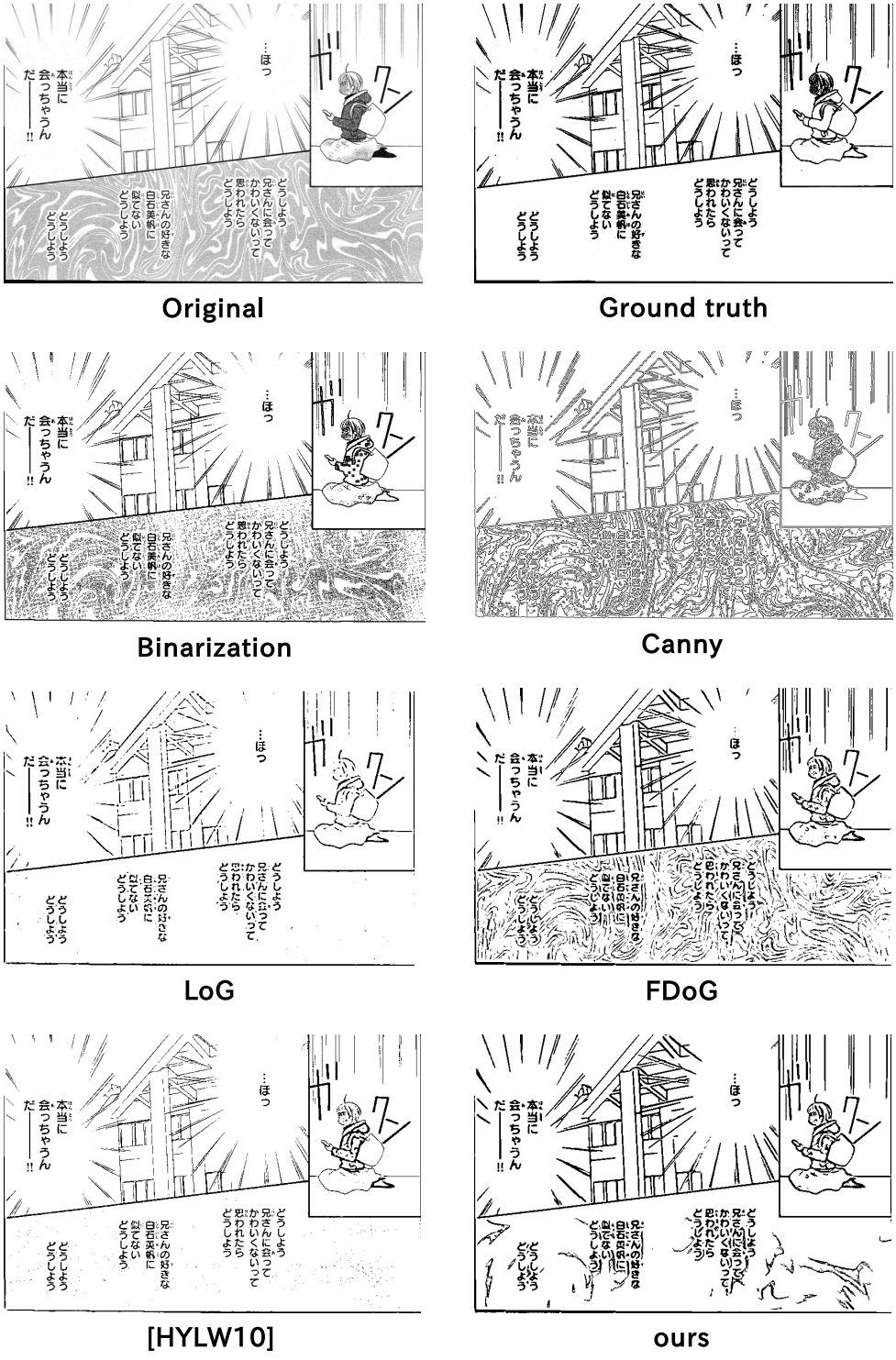


Figure 13: *Result 12* ©*Hotaru Yazawa*

Figure 14: *Result 13 ©Shouei Ishioka*

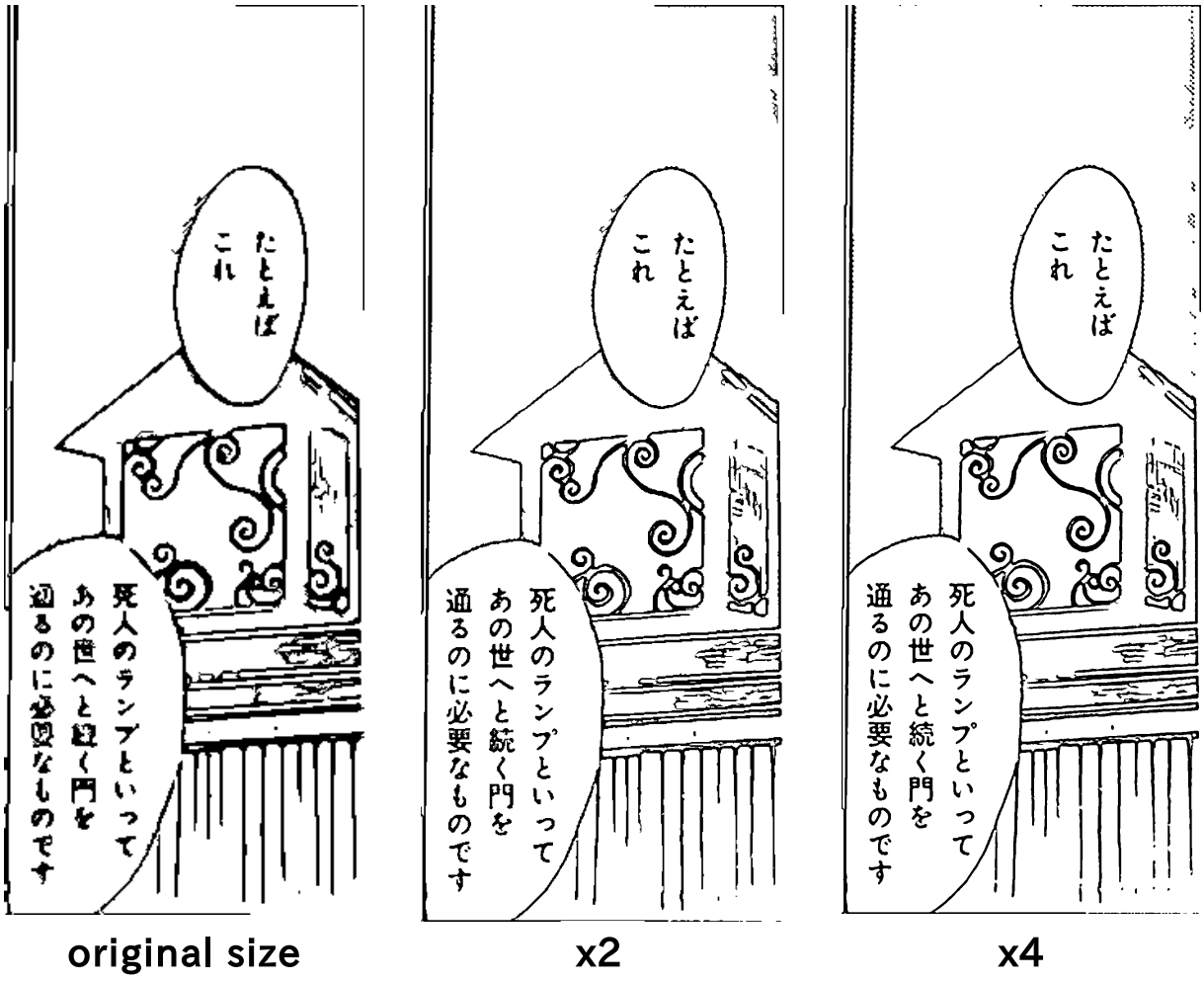


Figure 15: *Successful result 1.* ©*Junichiro Akabi*

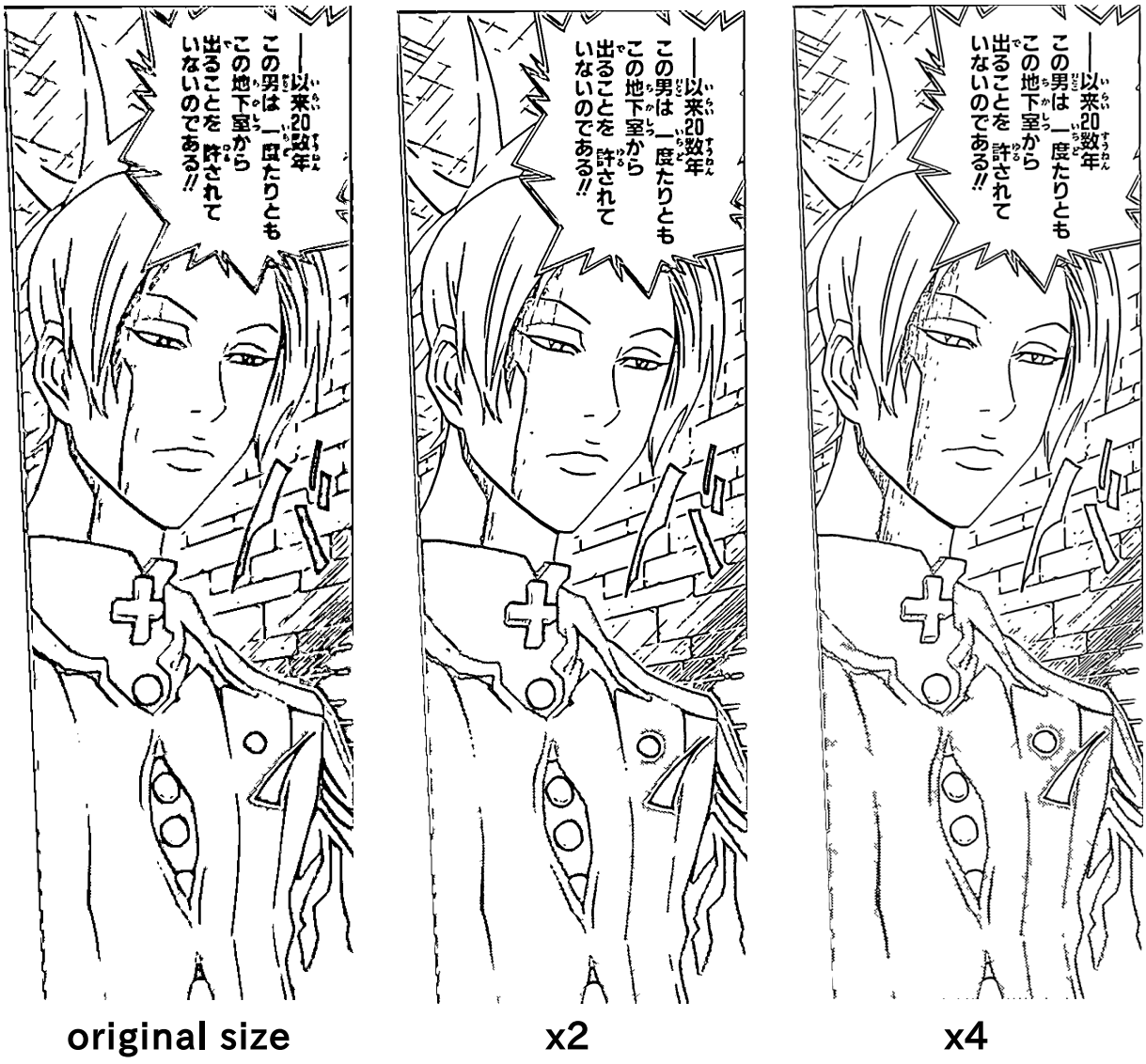
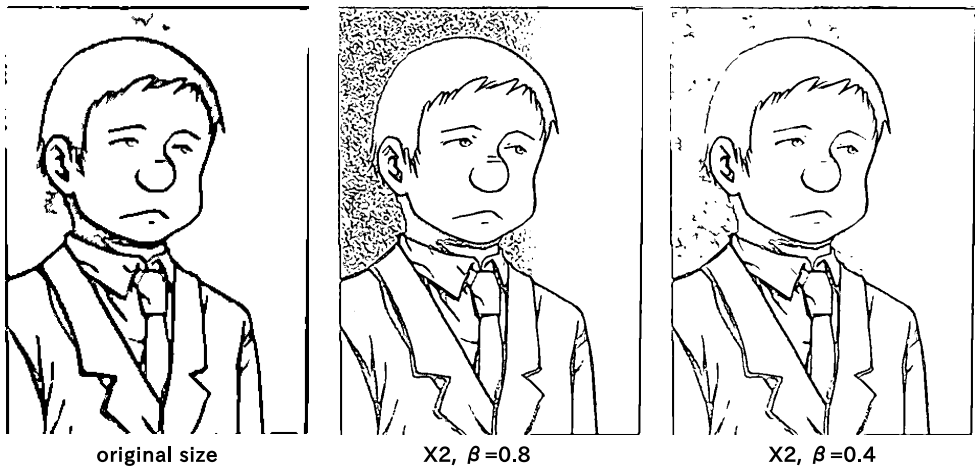
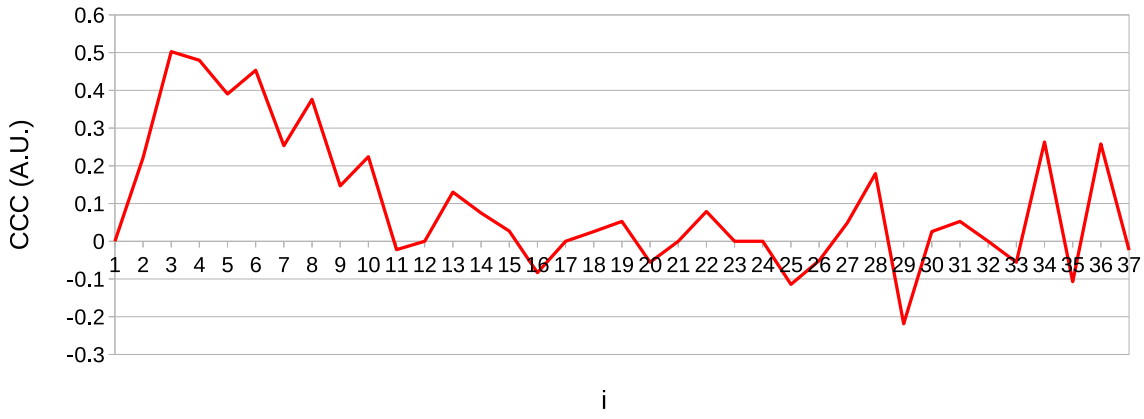


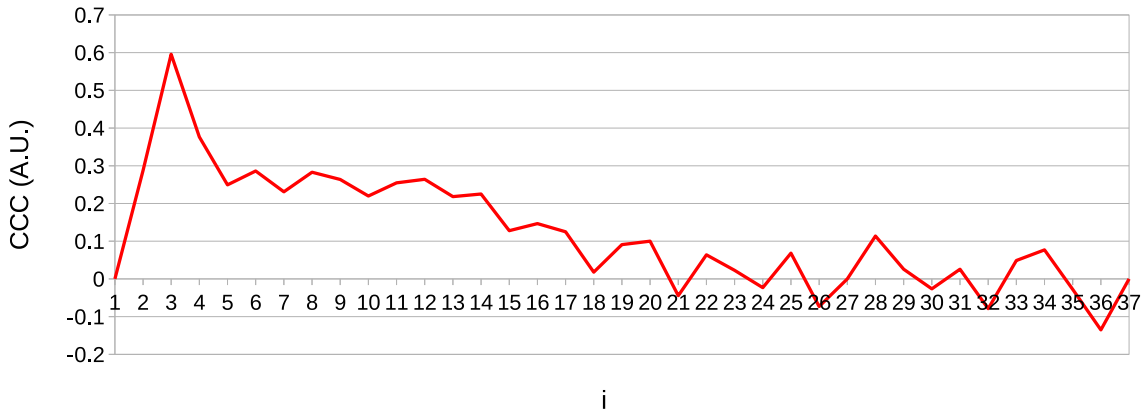
Figure 16: *Successful result 2.* ©*Shouei Ishioka*



(a) Result images. The left column shows the original size, the center column shows double the size with $\beta = 0.8$, and the right column shows double the size with $\beta = 0.4$.



(b) CCC sequence of original size.



(c) CCC sequence of double size.

Figure 17: *(a) Result images ©Junichiro Akabi (b) CCC for the original size (c) CCC for the double size.*